(12) UK Patent Application (19) GB (11) 2 062 361 A

(21) Application No 8024277
(22) Date of filing 24 Jul 1980
(30) Priority data
(31) 2944274
(32) 2 Nov 1979
(33) Fed. Rep. of Germany (DE)
(43) Application published
20 May 1981
(51) INT CL³
H02K 5/10 B23B 45/02
(52) Domestic classification
H2A BR
(56) Documents cited
GB 1443098
GB 1321456
GB 1292186
GB 1079844
GB 377290
GB 312879
GB 274553
(58) Field of search
H2A
(71) Applicants
Hilti Aktiengesellschaft
FL—9494 Schaan,
Liechtenstein
(72) Inventors
Franz Hoyss,
Rudolf Reitberger,
Johann Schweiger
(74) Agents
Barlow, Gillett & Percival,
94 Market Street,
Manchester, M1 1PJ

(54) Drilling tool

(57) To avoid penetration of water spray (e.g. from cooling water being sprayed at a location being worked or when working in the rain) into motor compartment 14 of an electric drill, a labyrinthine guide 5 is supplied by a cooling air suction inlet 7 which has a shield 12 in front of its entry and is fitted with at least one filter 8, whilst an outlet 16 is formed to deflect outgoing air and is provided with a closure in the form of a filter 17 or a flap valve 23, Fig. 1*a*. Both the inlet and the outlet provide 180° deflection of the air current impelled by fan 13. The inlet 7 may be adjustable in direction and can be demountable from housing 1 in a manner which breaks the current to the motor 3. The inlet 7 also incorporates a fine filter 11.

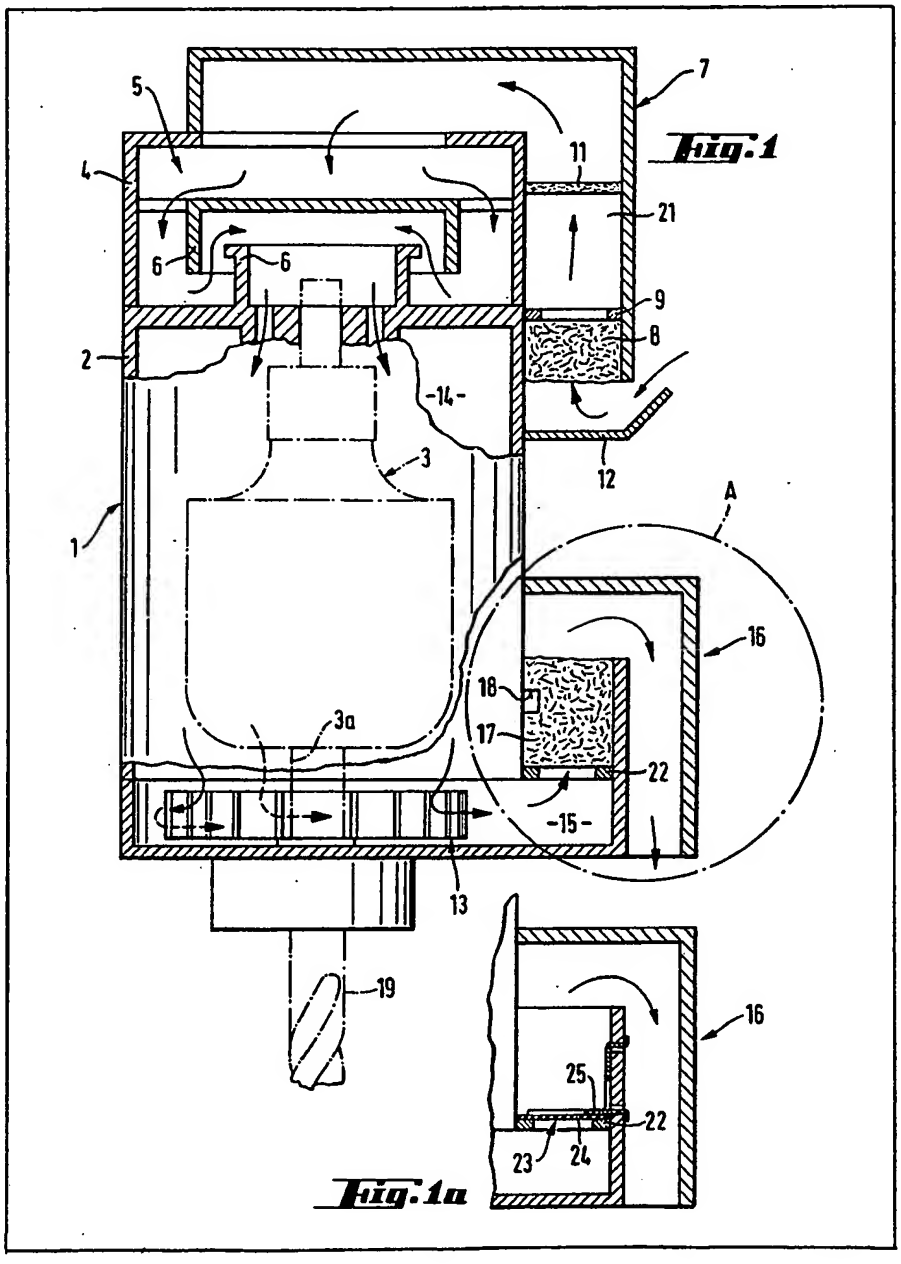

Fig. 1

Fig. 1a

GB 2 062 361 A

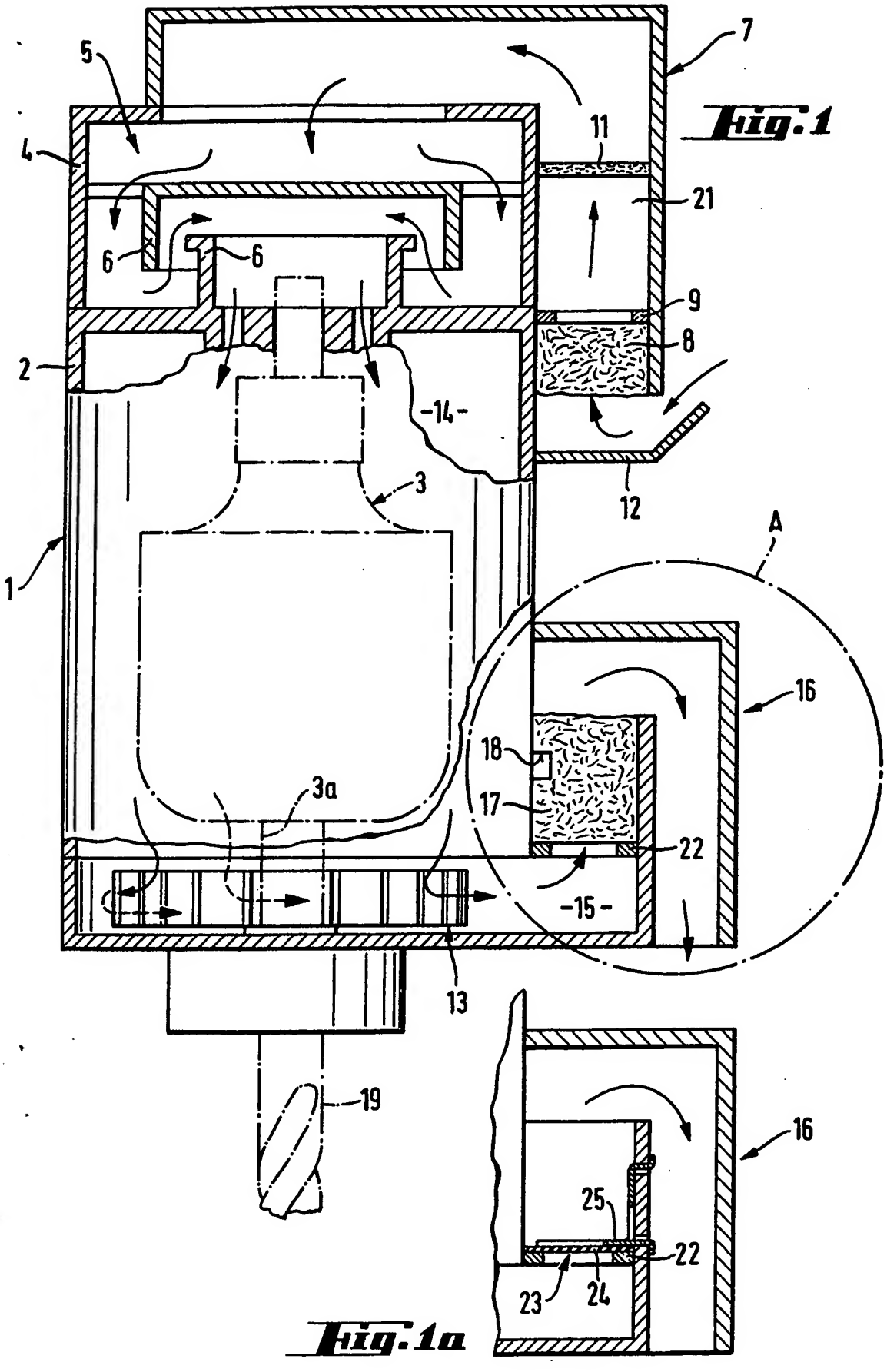

Fig. 1

Fig. 1a

SPECIFICATION

Drilling tool

This invention relates to a drilling tool having an electric motor which is protected against spray water and a cooled motor chamber in which said driving motor is disposed.

Drilling tools and other electrically-driven hand tools are exposed, in a plurality of instances of use, to wetting by spray water or the like. Spray water can, for example, be an undesirable occurrence attendant upon cooling the location being worked. Also, as is well known, spray water occurs, when the hand tool is used in the rain.

The elctric motor driven drilling tools are, as a general rule, cooled with air. In the case of conventional drilling tools, the problem exists that spray water can enter into the motor with the cooling air, so that the operator is exposed to the latent danger of reaching impermissibly high contact potentials.

This problem has been countered, in the case of drilling tools having rotary-current motors or condenser motors which disadvantageously have a performance characteristic which is extremely unfavourable for drilling tools, by providing a double-shell housing, in which an inner shell of the housing encapsulates the motor chamber in a water-proof manner. For the cooling, air is conducted through the spacing between the inner shell and the outer shell.

This ventilation (which is so-called "jacket ventilation") in the above-mentioned type of motor, brings about a cooling which is often only inadequate, so that it is not at all suitable for drilling tools which, in the majority of cases are equipped with universal motors. Universal motors are distinguished on the one hand by a favourable performance characteristic and on the other hand, as compared with rotary-current motors, by low weight and small volume.

The problem underlying the invention is to provide a drilling tool, having an electric driving motor, which has protection against spray water, combined with an air cooling arrangement which is also effective for universal motors.

In accordance with the invention, the problem is solved by providing a drilling tool having an electric driving motor which is protected against spray water, and a cooled motor chamber in which the said driving motor is disposed, characterised in that a suction inlet, which deflects the air into the motor chamber, is provided for the internal air cooling of the motor, there being a repelling shield in front of the suction inlet, as well as at least one filter in the suction inlet, and, between this filter and the motor chamber, a labyrinth guide and in that there is arranged, at the point of the cooling air, an outlet nozzle which deflects the cooling current and has a closure member which prevents entry of spray water through the outlet nozzle.

A suction inlet for the cooling air, the suction opening of which is screened off by the presence of the repelling shield in front thereof and has a first filter, prevents direct penetration of spray water, which may possibly occur after the manner of a fountain, into the cooling air stream. In addition, a channel formed by the suction inlet acts as a calming chamber for the cooling air sucked therein, in which is deposited any moisture not removed by the first filter. This can be carried away out of the suction inlet, for example by conventional means such as a one-way valve.

In order to ensure, in any position of use of the drilling tool, that the cooling current is deflected through the suction inlet, the latter is advantageously flexible or swingable in design, so that the suction opening can be adjusted in accordance with the direction in which it is least susceptible to the entry of spray water.

The cooling current, pre-filtered by way of the suction inlet or the means associated with it, then passes into the labyrinth guide, where it is repeatedly sharply deflected by baffle plates present there, which brings about precipitation of any final drops of water from the air current. The individual chambers of the labyrinth guide are conveniently so arranged that any moisture which may possibly accumulate here cannot advance into the motor chamber in any position of use of the hand tool.

The suction inlet is coupled to the housing part containing the labyrinth guide for example by way of a flange connection. For reasons of manageability it is advantageous to design this coupling so as to be releasable by a coded plug connection with which a plug connection for current supply is associated.

This gives a simple way of ensuring that, when the suction nozzle is not coupled up, the current supply for the motor is interrupted, so that operation of the hand tool in this state is not possible.

The dry air current, passing out of the labyrinth guide for the internal ventilation of the driving motor and into the motor chamber, is, for example, exhausted out of the motor chamber by a radial impeller driven by the motor and is carried off by way of an outlet nozzle into the open air. The latter has a closure member. This has the function, when the drilling tool is at a standstill, of preventing any penetration of spray water or moisture, by way of the outlet nozzle, into the motor chamber.

Preferably the suction inlet has an 180° curvature for deflecting the cooling current. In this way adequate deflection of the cooling current between the suction opening and the labyrinth guide is ensured with certainty, irrespective of the position of use of the drilling tool.

In order, to ensure that the outlet nozzle for the cooling air leaving the motor chamber also substantially prevents penetration of spray water and the like in any position of use of the drilling tool, more especially in non-operation of the same in accordance with a further development of the invention the outlet nozzle has a 180° curvature for deflecting the cooling current.

Any moisture which may penetrate through the first filter into the suction inlet can advantageously

be kept away more extensively by a fine filter arranged at a geometrical spacing from the first filter. The chamber existing between these two filters receives water residues held back there.

Preferably the closure member in the outlet nozzle is designed as a filter. In order to carry away any water which might possibly advance as far as the filter, a drain, designed for example as a one-way valve, can be provided in the region of this filter.

In accordance with another development of the invention, a valve is provided as the closure member in the outlet nozzle. Suitable for this purpose is, inter alia, a flap valve which, in the shutdown condition of the drilling tool, closes the outlet nozzle. This valve then prevents penetration of water, or water vapour, through the outlet nozzle when the drilling tool is shut down.

The invention will be described further, by way of example, with reference to the accompanying drawing in which:—

Fig. 1 is a diagrammatic sectional elevation illustrating a practical embodiment of the drilling tool of the invention; and

Fig. 1*a* is a detached fragmentary view corresponding to the part circled at A in Fig. 1, but showing a modification.

The drilling tool shown in Fig. 1 comprises a housing which is designated as a whole by the reference numeral 1 and which comprises a front portion 2 in which a motor 3 is mounted, and a rear portion 4 the internal space of which has a labyrinth guide, designated as a whole by the numeral 5, for an air cooling current. The labyrinth guide 5 is, for its part, formed by ribs 6.

Connected to the housing 1, in the region of the rear portion 4, is a suction inlet which is designated as a whole by the numeral 7 and in the intake opening of which is arranged a first filter 8. A spring ring or disc 9 prevents the filter 8 from being able to penetrate too deeply into the suction nozzle 7. Furthermore, a fine filter 11 is provided in the suction inlet at a geometrical spacing from the first filter 8, which is preferably in the form of a coarse filter. Disposed in front of the suction opening of the suction inlet 7, also at a geometrical spacing with regard to the filter 8, is a repelling shield which is secured, for example, to the housing 1 and which prevents direct entry of spray water into the suction opening.

A radial impeller 13, which is secured to the motor shaft 3*a*, serves to propel the cooling current, as indicated by arrows, out of motor chamber 14 by way of a housing-side annular channel 15, surrounding the radial impeller 13, into an outlet nozzle associated with the front portion 2 of the housing 1 and designated as a whole by the numeral 16, and then into the open air. In so doing, the cooling current passes through a further filter 17 which is located by a ring 22. The primary purpose of this filter 17 is to prevent penetration of moisture by way of the outlet nozzle 16 into the interior of the tool when the drilling tool is out of operation. Any water which may have advanced as far as the filter 17 and have become trapped there can escape by way of a lateral run-off opening 18. Furthermore, by way of example, a tool, for example a drill bit 19, is shown clamped into the drilling tool in the drawing.

With the arrangement as above described, in operation of the drilling tool the cooling current is introduced between the repelling shield 12 and the suction opening of the suction inlet 7 by way of the filter 8 into the passageway of the suction inlet. Any water which may possibly pass through the filter 8 is held back in the next stage, at least to a substantial extent, by the subsequent fine filter 11 in the intermediate chamber 21 formed between these two filters.

Then, the cooling current is deflected abruptly and repeatedly by the labyrinth guide 5, so that any last particles of moisture are deposited there. Possible moisture deposited in drop form in the suction inlet 7 is prevented by the labyrinth guide 5 from passing into the motor chamber 14 in any position of use of the drilling tool.

To provide for the possibility of encountering extreme amounts of spray water, and for further safety reasons, it may be advantageous to provide additional filters and baffle plates in the cooling current guide 5 in front of the motor chamber 14. Equally such measures can also be of additional advantage for the region of the outlet nozzle 16.

In the modification illustrated in Fig. 1*a*, there is provided, in the outlet nozzle 16, instead of a filter, a valve which is designated as a whole by the numeral 23 and which prevents water and other matter from penetrating through the outlet nozzle. The valve 23 comprises a closure disc or flap 24 made of elastic material, such as rubber, and a spring 25 which biasses the disc or flap 24 against the ring 22. When the drilling tool is running, the closing disc or flap 24 is lifted by the cooling current, against the force of the spring 25, from the position shown, and the valve 23 is thus opened for passage of the cooling current.

Other modifications may be made within the scope of the invention as defined by the following claims.

CLAIMS

1. A drilling tool having an electric driving motor which is protected against spray water, and a cooled motor chamber in which the said driving motor is disposed, characterised in that a suction inlet, which deflects the air into the motor chamber, is provided for the internal air cooling of the motor, there being a repelling shield in front of the suction inlet, as well as at least one filter in the suction inlet, and, between this filter and the motor chamber, a labyrinth guide and in that there is arranged, at the outlet point of the cooling air, an outlet nozzle which deflects the cooling current and has a closure member which prevents entry of spray water through the outlet nozzle.

2. A drilling tool as claimed in claim 1, characterised in that the suction inlet deflects the cooling current through 180°.

3. A drilling tool as claimed in claim 1 or 2, characterised in that the outlet nozzle serves to deflect the cooling current through 180°.

4. A drilling tool as claimed in claim 1, 2 or 3, characterised in that a fine filter is arranged in the suction inlet subsequent to the first filter at a spacing from the latter.

5. A drilling tool as claimed in any preceding claim characterised in that the closure member of the outlet nozzle is designed as a filter.

6. A drilling tool as claimed in any of claims 1 to 4, characterised in that the closure member of the outlet nozzle is in the form of a valve.

7. A drilling tool substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.